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ABSTRACT

Project SITE (Successful Inservice through Turnkey Education) is an exemplary staff development program which provides training in mathematics content and appropriate methodology to elementary school teachers (grades 2-6). Participants interact with manipulative materials, taking an active role in their own concept development and learning of mathematical skills. Effective instruction in metric measurement must incorporate a number of mathematics concepts and skills, such as estimation, place value, decimals, area, perimeter, and volume, and Project SITE curricula includes these as well as several other topics. Participants receive 4 days of mathematics instruction, spaced over a period of time, to allow for classroom tryouts of activities and materials. Upon completion of the training sessions, the second phase of the inservice program begins. This phase involves the training of other teachers in each participating school building or district via the multiplier approach. The original participants, or turnkey teachers, conduct inservice programs for their colleagues. The turnkey workshops are conducted during various time periods, and the presence of the turnkey trainers in each participating building permits the program to respond to individual school needs. The Project SITE staff development program has proven to be an efficient means of providing mathematics instruction to elementary school teachers. (JMK)

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A RESEARCH-BASED STAFF DEVELOPMENT MODEL:

THE PREMISE AND THE PROGRAM

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In the current educational milieu, inservice education is receiving greater attention than ever. Although staff development programs are expensive in terms of money and time, the need for them has increased because of the stabilization of teaching staffs. The concomitant decrease in the number of new teachers entering the system with up-to-date knowledge of subject matter and/or techniques (McLaughlin & Berman, 1977; Buder, 1977) adds to the problem. The cost of these programs may be justified to a critical public only if they result in demonstrated student improvement.

Researchers have analyzed staff development programs from all parts of the country with great care. Those programs which were considered successful were found to possess similar characteristics. This paper will detail these characteristics and then describe a nationally-validated mathematics inservice program based upon them.

EFFECTS OF INSERVICE ON STUDENT ACHIEVEMENT

Studies of the effects of inservice education on student achievement have shown that a positive relationship does exist. Statistically significant student improvement has been found to occur as a result of teacher inservice, irrespective of grade level or subject area (Berman, 1981; Fitzmaurice, 1976; Good & Grouws, 1979; Houston & DeVault, 1963; Ruddell & Balow, 1963).

One frequently-used method of conducting staff development is the multiplier or turnkey approach. This strategy is considered highly appropriate for use in areas where many teachers from different buildings (or districts) require the same inservice training. It involves the training of selected teachers in a particular topic and their subsequent employment as inservice workshop leaders for others in their school or district. The multiplier strategy has the potential of providing for staff development, utilizing local resources, to train a large number of personnel within a relatively short period of time (Tobin & Dye, 1977; Wirtz, 1974).

Researchers evaluating student achievement as a result of teacher inservice based on a turnkey approach found that statistically significant growth in knowledge occurred in students of both the original trainers and their trainees (Berman, 1981; Dilworth & Warren, 1973; Lawson, 1978; Orlich et al., 1973; Pepperman, 1974). The multiplier strategy thus appears to be an efficient, cost-effective staff development technique. It provides an opportunity to key inservice training to the needs of the individual school building and may be directed by a teacher from that building who understands the unique problems faced by his/her colleagues.

COMPONENTS OF EFFECTIVE INSERVICE

Experiential Learning

Cognitive psychologists assert that learning takes place through the interaction of the individual with materials, peers and the instructor. Learning is described as a developmental process, with each new concept built upon previously-existing knowledge. Individuals learn by manipulating objects to their environment, then by reacting to representations of these objects and, finally, operating with the abstractions that result from these experiences.

Empirical data on adult cognitive development is still rather sparse. However some researchers have documented evidence which supports the need for experiential learning at the adult level (Bender & Milakofsky, 1982; Blasi and Hoeffel, 1974; Joyce & Showers, 1980; Oja, 1980; Wood & Neill, 1978). Apparently, a large proportion of adults are operating at the concrete operational, not the formal, stage of intellectual development.A discovery-oriented, problem-solving approach to learning thus appears to be as important for adults as it is for children. This assumption is supported by Richard Skemp in his book on the psychology of learning mathematics.

> We all have to go, perhaps more rapdily than the growing child, through similar stages in each new topic which we encounter . . . . The mode of thinking available is partly a function of the degree to which the concepts have been developed in the primary system. One can hardly be expected to reflect on concepts which have not yet been formed, however well-developed one's reflective system (Skemp, 1971, p. 66).

What the foregoing suggests is that teachers may need to learn new concepts and skills in an active learning environment using concrete materials when needed, in hands-on activities. Inasmuch as teachers tend to teach the way they were taught (Dilworth, 1973; Fuson, 1975), the experiential approach to staff development[3] assumes great significance. Appropriately-designed inservice education can become the model for increased use of hands-on, activity-oriented programs with elementary students.

CHARACTERISTICSOF EFFECTIVE INSERVICE

As a rule, effective inservice programs involve a continuous theme, over a period of time, interspersed with classroom tryouts. Teacher's expressed needs often form the starting point and teacher input is included early in the program. Curriculum change and innovation are dealt with by providing teacher training prior to the onset of a new classroom program. Teachers gain a knowledge of the subject matter in the curriculum before and after their particular grade levels (Orlich & Ezell, 1975).

The successful projects have immediate applicability in the classroom because they combine subjct-matter content with teaching methodology,

the use of manipulatives and the construction of teacher-made materials. Activities for teachers that parallel those to be used with children are employed, thus crating a model for subsequent classroom application (Berman, 1981; Friederwitzer, 1981; Dutton & Hammond, 1966; Nicholson, et al, 1976). Another, important consideration is the inclusion of on-going, continuous evaluation of the process, the participants and the effect of the program on students.

The goals of inservice education must be carefully considered before programs begin. Teachers should be provided with the time, the opportunity, the means and the materials for improving professional competence. They should receive assistance with the development of creative instructional approaches that are meaningful and appropriate to students. Training in the implementation of innovative curricula or instructional practices and aid in applying new insights into the learning process to themselves and their pupils must be available (McCormick, 1979; Tye & Benham, 1978).

The success of staff development programs is thus dependent upon many variables. The subject matter presented, teaching methods demonstrated, extent of participant involvement, ease of application in the classroom, choice of instructor, location and time of sessions are all factors which affect the success or failure of an insevice program.

AN EXEMPLARY STAFF DEVELOPMENT PROGRAM

Project SITE: (Successful Inservice through Turnkey Education) was nationally validated by the Department of Education Joint Dissemination Review Panel. It is currently funded by the National Diffusion Network for the 1982-83 school year.

The purpose of Project SITE is to provide inservice training in mathematics content and appropriate methodology to elementary teachers (grades 2-6). Since elementary teachers are often poorly prepared and/or uncomfortable in mathematics, they frequently "resist" inservice that is designed to teach them mathematical content. They may resent the implication that they "don't know" the subject and need more training, even though it is true.

Project SITE's curriculum continues the mathematical education of elementary teachers using measurement as the vehicle of instruction. Participants interact with manipulative materials, taking an active role in their own concept development and learning of mathematical skills. A unified, cohesive program is created out of normally disparate components through the integration of mathematical content and teaching methodology based on learning theory with practical classroom applications. This type of course has not traditionally been part of the preservice or inservice training of a majority of elementary school teachers. Thus the dissemination and implementation of the SITE program becomes the means for providing instruction in mathematics content and appropriate methodology to elementary teachers

in an innovative, non-threatening way.

Background

Project SITE is an outgrowth of a program originally developed at the Rutgers University Graduate School of Education from 1975-80. The Rutgers program, created in response to a U.S. Office of Education initiative, provided education in the metric system of measurement to teachers and students in New Jersey. Inasmuch as the concepts and skills embodied in the metric system were unfamiliar to most elementary school teachers, an in-depth staff development program in many school districts was needed before implementation of metric activities could begin with pupils. The multiplier (or turnkey) strategy became the basis for the inservice interventional plan which operated successfully for four years in uban and suburban school districts spanning a variety of socioeconomic levels. The effectiveness of the staff development program was measured by the achievement of students whose teachers participated.

In succeeding years, the program was disseminated nationally by Educational Support Systems, Inc. under Department of Education funding. It is currently operating in schools in New Mexico, Vermont, New Hampshire, the Virgin Islands, and New Jersey.

Design

The SITE program was designed to incorporate the characteristics of effective inservice programs described above. The inservice guide, Measurement in the Elementary School was written specifically for this program. It was based on developmental theories of learning espoused by cognitive psychologists. The theoretical framework the program also includes recent findings on teaching/learning styles, experiential learning for adults and research by mathematics educators on appropriate models of instruction for teaching new mathematical ideas.

METHODOLOGY AND CONTENT

The advent of the metric system and the need for all segments of the population to learn it affords the opportunity of providing mathematics inservice training under a new umbrella. The methodology focuses on problem-solving, using manipulative materials in hands-on activities. Each new section of mathematics and metric content builds upon concepts developed in preceding sections to evolve an integrated, systematic understanding of the entire metric system and the mathematics included in it.

Effective instruction in metric measurement must incorporate a number of mathematics concepts and skills, i.e. estimation, place value, decimals, area, perimeter and volume. The Project SITE curriculum includes these as well as a number of other topics such as graphing,

statistics, ratio and proportion, which are frequently omitted from elementary mathematics instruction.

Activities integrating mathematics and metrics with other subjects in the elementary and middle school curriculum are utilized. For example, scientific concepts such as the Archimidean principle of finding volume by the displacement of water, are developed in the capacity-volume section. Activities for social studies (e.g. scale drawings, map reading), home economics (e.g. consumerism), physical education (e.g. racing), language arts (e.g. creative writing) as well as art and music are included when appropriate.

Since teachers tend to instruct the way they were taught, as well as the way they learn, the program incorporates activities for teachers which parallel those suggested for children. The teaching methods used by the project trainers, the manipulative materials employed at the workshops and the printed matter distributed, are all intended to serve as models for subsequent use by participants.

THE SITE PROGRAM

Each district or school is requested to send at least one supervisor to attend the entire training series alongside their teachers. The participation of principals and/or district supervisors is considered crucial. Their presence and involvement in the inservice sessions is an indication to their teachers of the importance placed on the training. Futhermore, their attendance enables them to develop a working understanding of the content and methodology of the program so that assistance and support can be provided during the implementation phase of the program. As the Rand report aptly states, principals are "the gatekeepers of change" (Berman & McLaughlin, 1978), who can enhance or destroy a new project.

Participants receive four full days of mathematics instruction, spaced over a period of time, to allow for classroom tryouts of activities and materials. Upon completion of the initial training sessions, the second phase of the inservice program begins. This phase involves training the other teachers in each participating school building or district via the multiplier approach. The original participants, or turnkey teachers, conduct inservice programs for their colleagues using the project Inservice Guide, a detailed "Script for Workshop Leaders" which parallels the activities used at the original workshops and a Starter Kit of equipment purchased from the project. This strategy allows the program to multiply the benefits of the original inservice experience, without a concomitant increase in cost.

The turnkey workshops are conducted during a variety of time periods. Some districts elect to schedule one or more inservice days specifically for SITE training. Other districts and schools use the time mandated for after-school faculty conferences to present the inservice program over a period of several months.

The presence of turnkey trainers in each participating building permits the program to respond to individual school needs. The turnkey teacher is able to tailor inservice to the particular needs of

his/her colleagues. All teachers, turnkeys and colleagues, are expected to implement the program with students using the easily-replicable activities through which they themselves learned.

EVALUATION

All participating teachers and students are pre- posttested. The criterion-referenced tests employed were developed for the project and have been found valid and reliable. In the past, students and teachers alike have exhibited signigicant growth in knowledge from pre- to posttest at, as a minimum, the 5% level.

In addition to the objective testing, ongoing subjective evaluation is conducted by turnkeys and colleagues, principals, district supervisors, and project staff. Supervisory evaluations have reported increased enthusiasm for mathematics by teachers and students, and greater use of manipulative materials by project participants when teaching other mathematics topics. The active learning approach utilized by participants while implementing this program has, in many instances, een extended to other curricular areas. Turnkey teachers have frequently continued to serve as inservice workshop leaders for their districts in succeeding years.

CONCLUSION

The efficacy of the SITE project was measured by the growth in knowledge (i.e. increased achievement) of teachers and students. During each year of operation, all participants showed statistically significant gains from pre to posttest. This staff development program has thus proven to be an efficient means of providing mathematics instruction mathematics to thousands of teachers and, through them, to tens of thousands of children.

The rationate underlying the development of the instructional materials and procedures used by Project SITE was derived from theories advocated by cognitive psychologists as to how learning occurs. The successful implementation of the program over a period of several years suggests that instructional formats for adult learners which follow developmental, sequential patterns, incorporating activity-oriented approaches, can increase subject matter knowledge while simultaneously modelling future behavior. Through their participation in the SITE inservice workshops, the turnkey teachers learn mathematics and metric content as well as appropriate teaching strategies. The new knowledge and instructional techniques are utilized subsequently for training colleagues and teaching students.

IMPLICATIONS FOR STAFF DEVELOPMENT

Aside from the positive results described, this approach to staff development offers residual benefits to participating school districts. Through the training of personnel already on the job, a cadre of staff developers available for future service is created. The presence of residual resource personnel in each school building also permits "individualization" of the program. The resource

personnel can tailor the contents and methodology of inservice sessions to the particular neds of the school. Additionally, they are available to provide immediate assistance and advise colleagues as problems arise.

Utilization of the multiplier strategy thus becomes a cost-effective tool enabling school districts to provide expanded staff development programs without a concomitant increase in funds. The initial training costs incurred in developing a cadre of resource personnel are more than repaid in future years as the trainers are called upon by their districts to conduct additional staff development programs. Futhermore, the benefits of this residual inservice cadre will be multiplied year after year, as the trained techers continue to implement classroom programs with their students.

The project format, with its multiplier strategy, is adaptable to a variety of content areas, further enhancing the utility of this model as an instructional vehicle for teachers and, subsequently, for students. Adaptation of this inservice model would permit school districts to implement cost-effective staff development programs with the reasonable expectation that student achievement would increase as teachers gained knowledge of new subject areas and appropriate teaching strategies.

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